Algorithm Changes for Version 6

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Error Estimation and Propagation

Objectives: improved stability of the MIT MW-only retrieval and more accurate characterization of error characteristics.

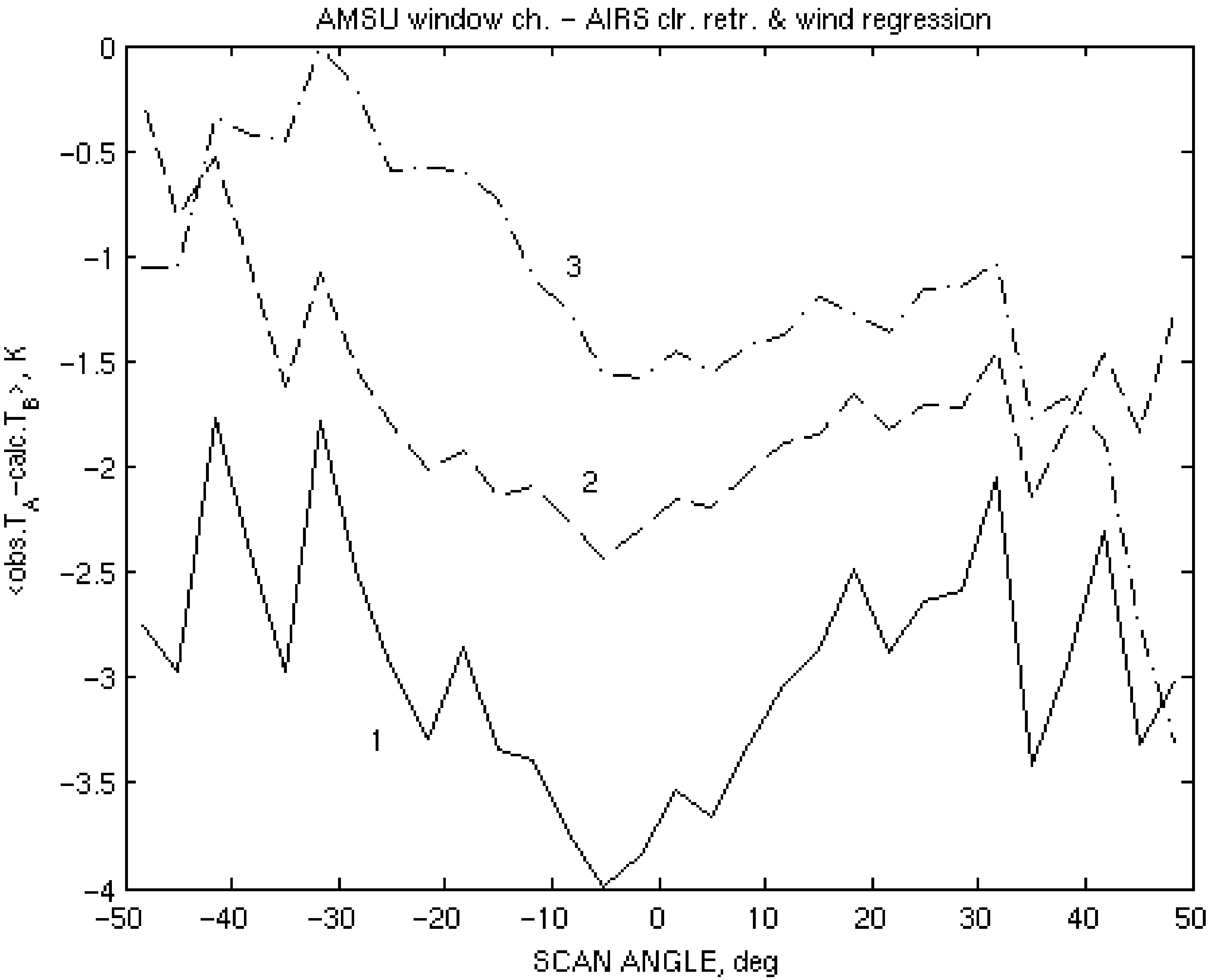
1. Include forward-model error covariance due to 5 mb uncertainty in surface pressure.

2. Use real-time per-granule noise estimates from Level 1 for AMSU channels 3-14.

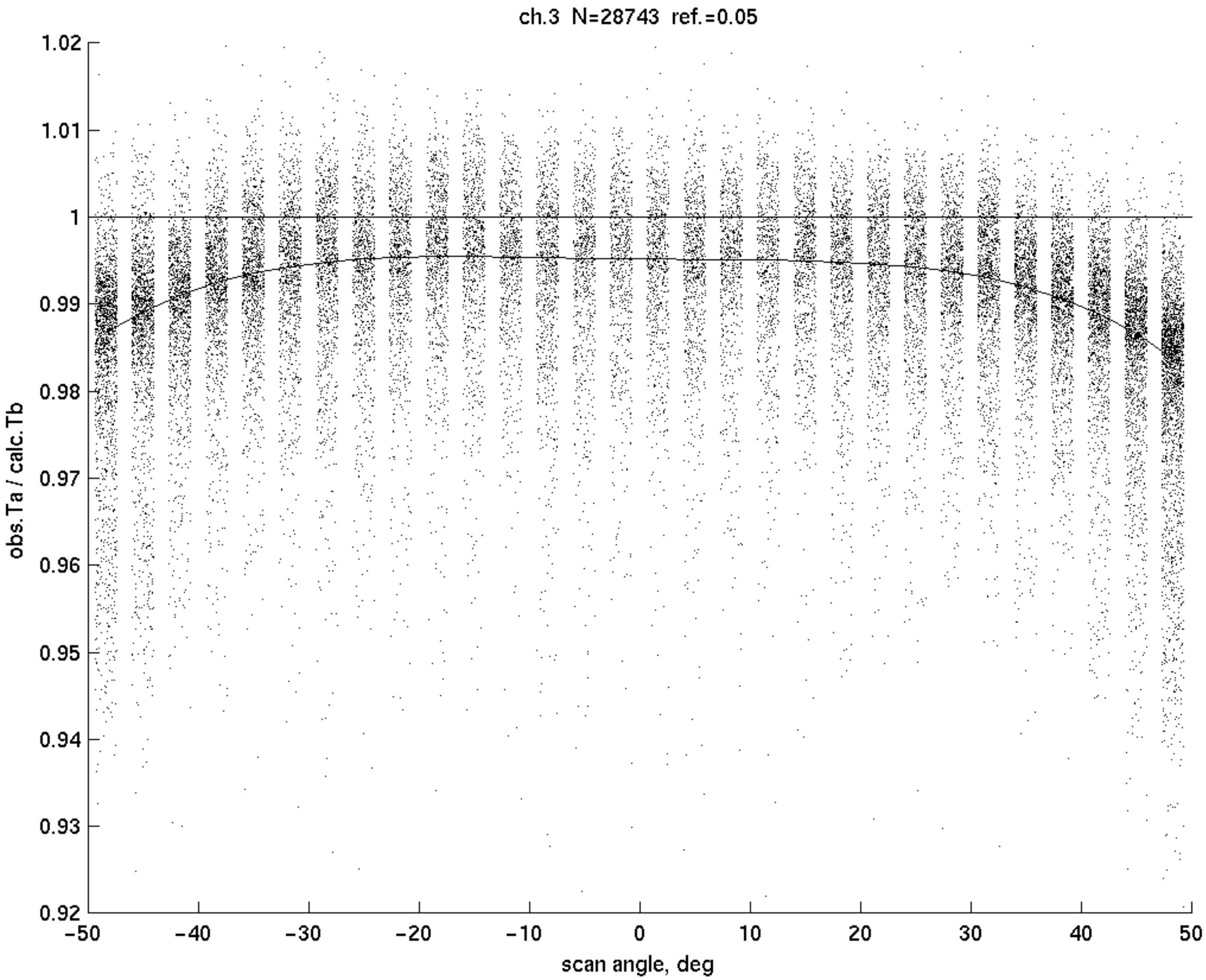
Revision of AMSU Tuning

- Objective: reduce bias error on land and polar regions.
- Used NOAA's expanded clear-air retrieval set including land cases.
- Minor (~1%) revision of atmospheric transmittance.
- Scene-dependent tuning (slope) for AMSU channels 1, 2, 3, 4, 15; bias tuning for channels 5-14. $T_B = \text{bias} + \text{slope} * T_A$
- Sounding-channel (4-14) tuning coefficients were calculated from AIRS profiles over ocean (landfrac<0.01).
- Window-channel (1, 2, 3, 15) obs/calc ratios were calculated from AIRS profiles over land (landfrac>0.85). Median reflectivity = 0.05 for land was determined from chan. 3 by requiring agreement between land and ocean obs/calc ratios near nadir.

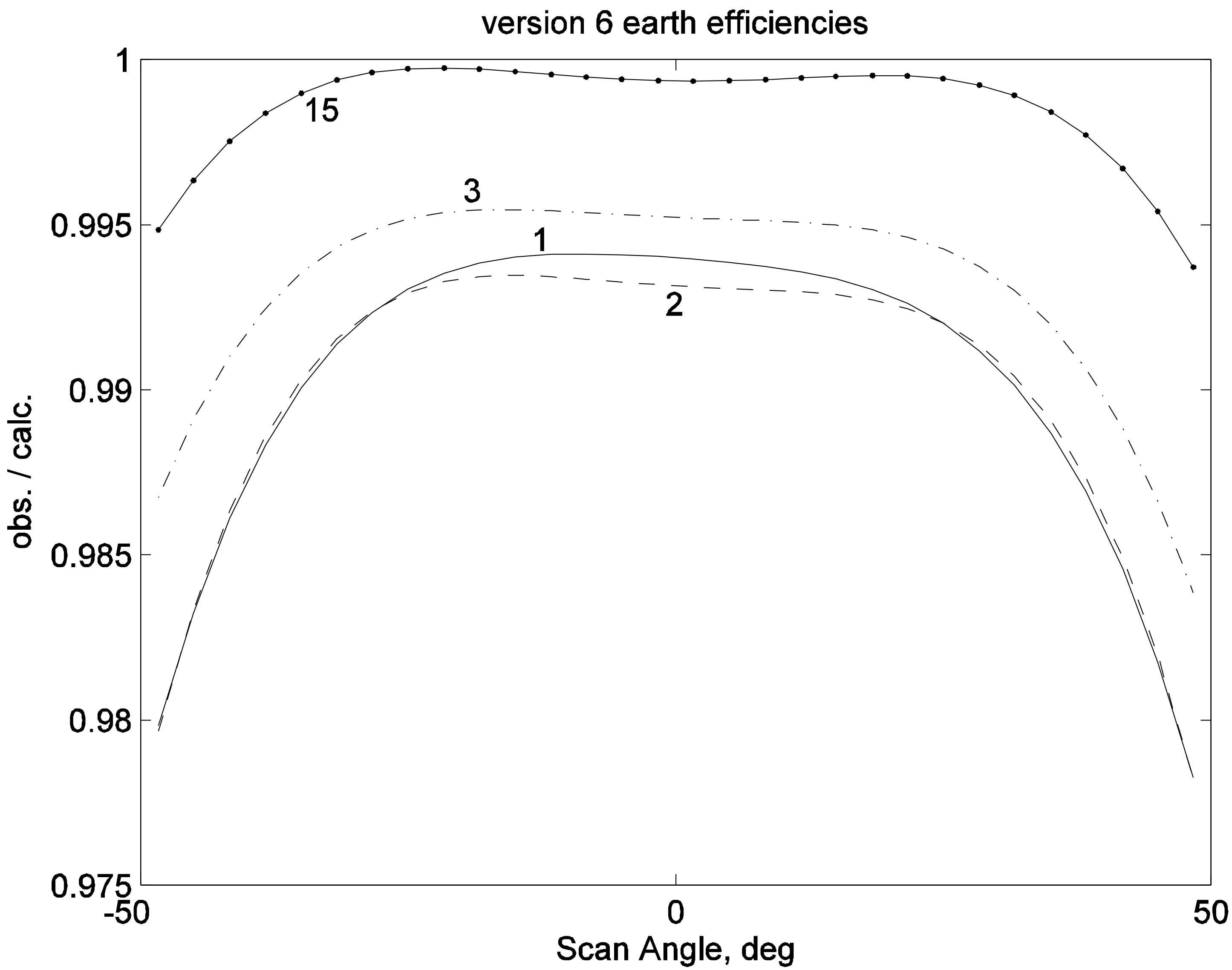
Version 5 bias for window channels showed evidence of residual cloud contamination



Using data over land, a 4-th degree polynomial was fitted to the median(obs/calc) as a function of scan angle.

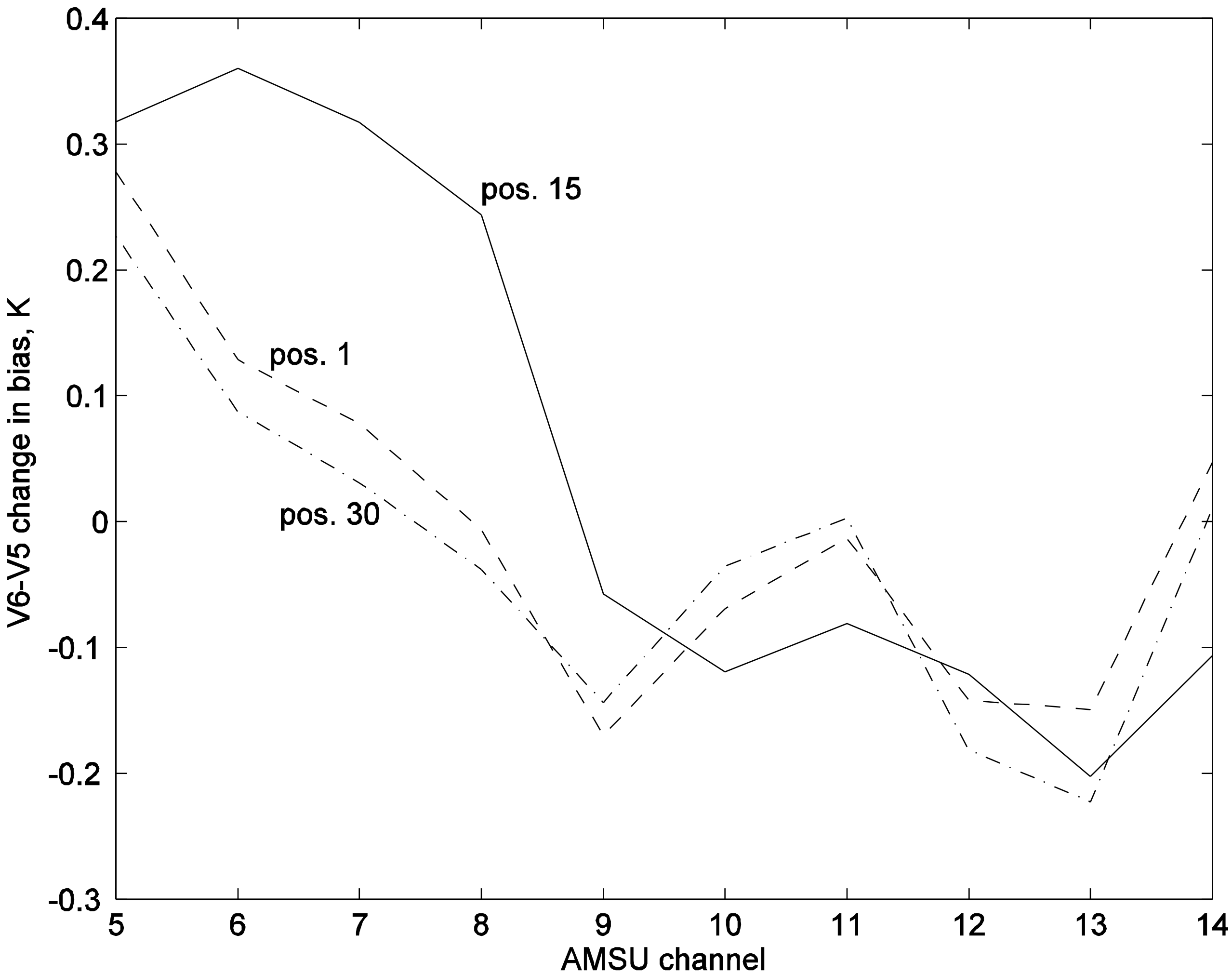


New results for the window channels resemble the expected effects from sidelobes.

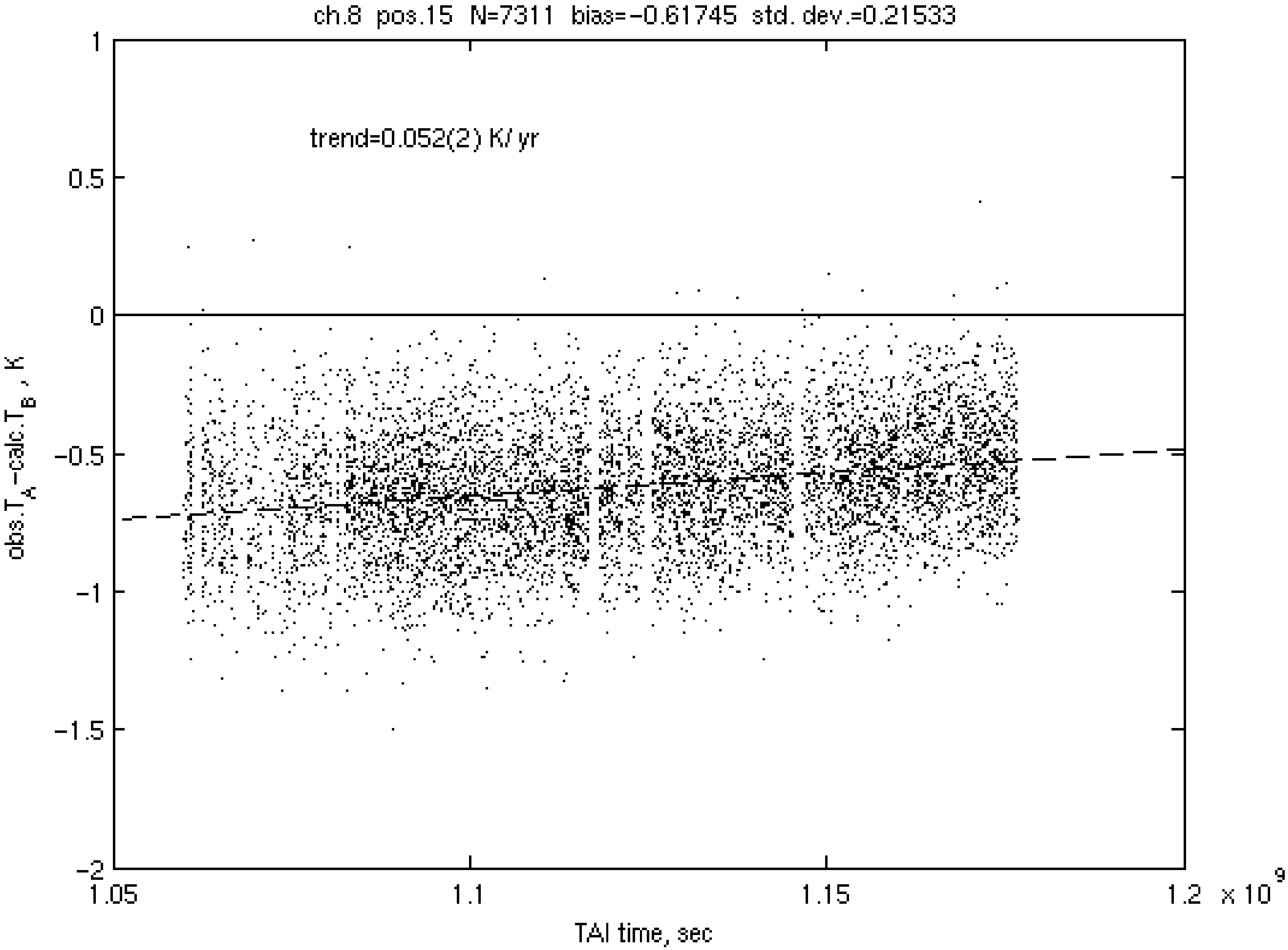


note: slope = 1 - 1/median(obs/calc).

Sounding channel offsets changed slightly from version 5.

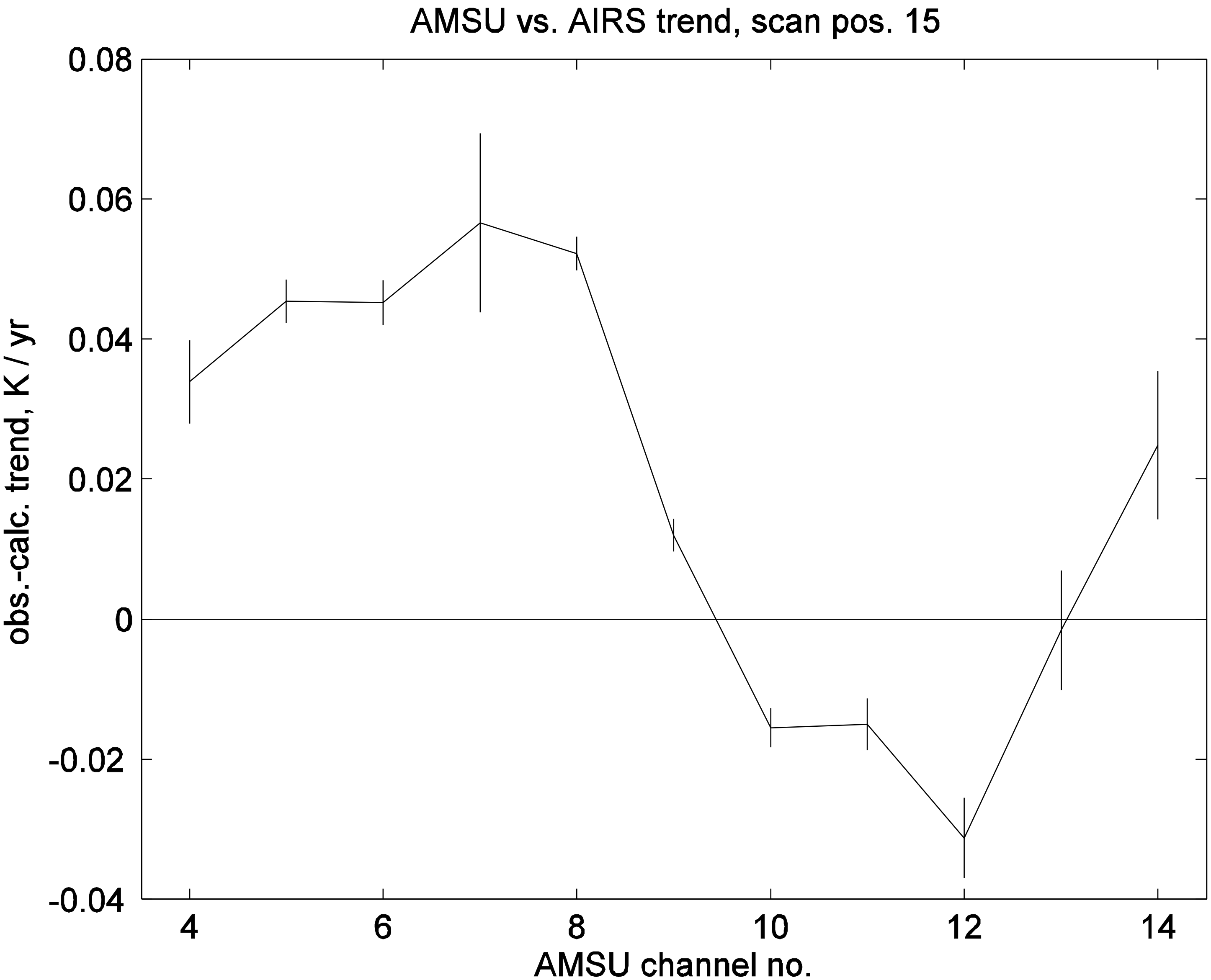


The relative bias of AMSU relative to the AIRS retrieval has a long-term trend.



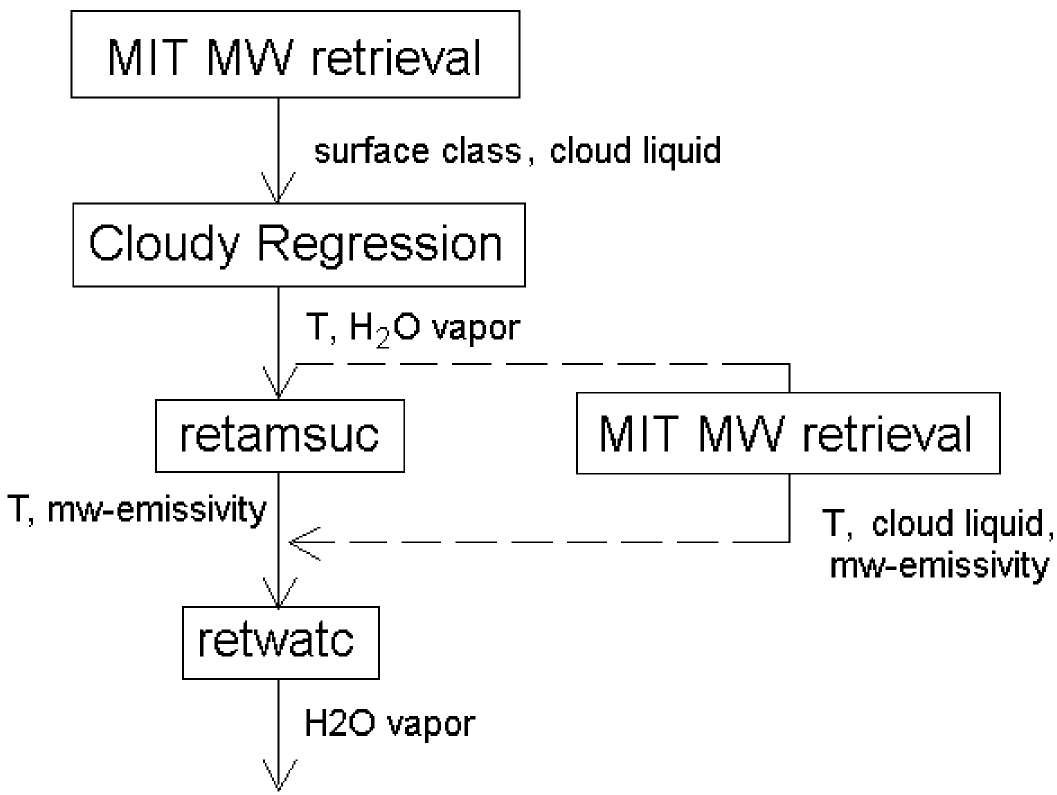
(~3.5 years)

The relative trend is positive in the troposphere and slightly negative in the stratosphere.

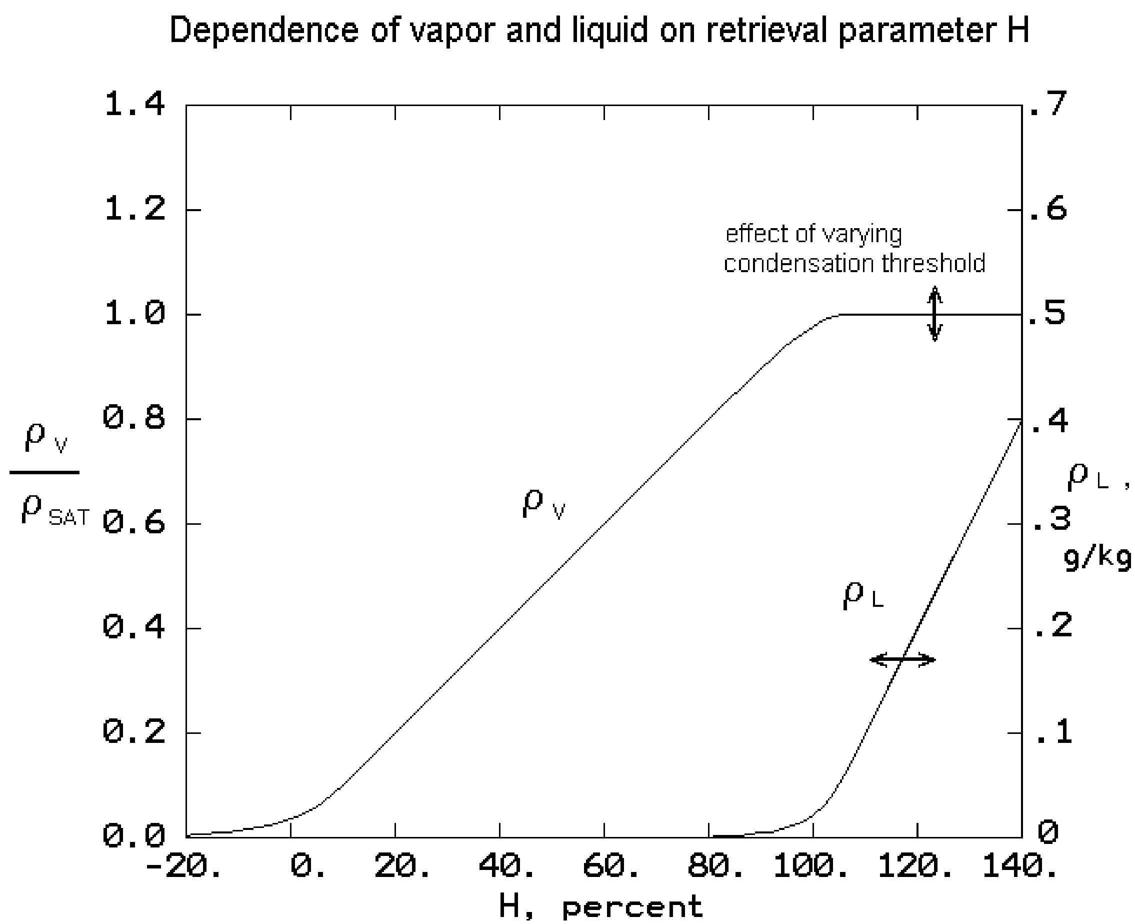


Second Pass of MIT Retrieval after Cloudy Regression

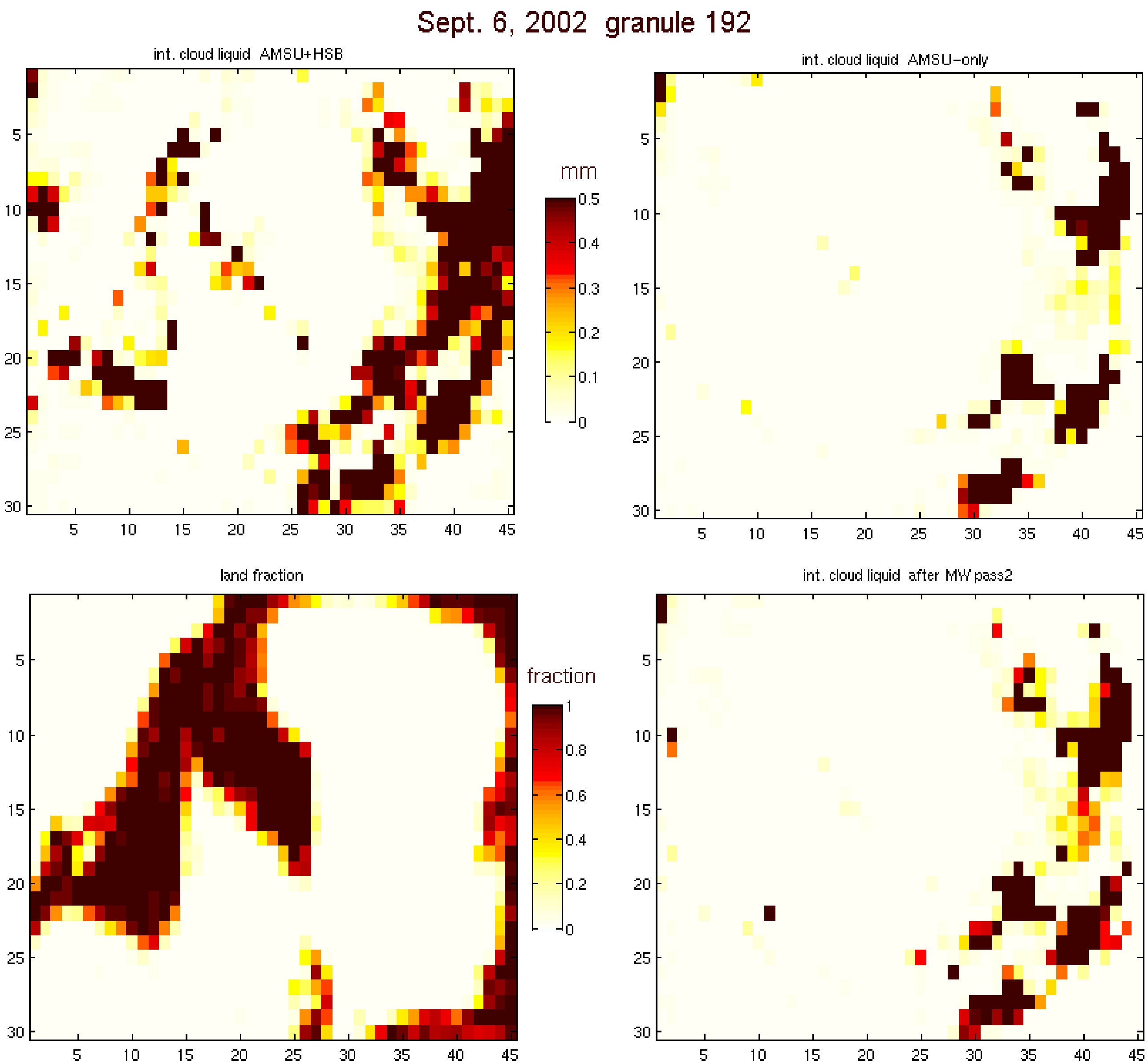
Objective: compensate for loss of HSB in cloud liquid retrieval.
The second pass should use error-covariance matrices appropriate to cloudy-regression temperature and relative humidity profiles. The preliminary experiments shown here are sub-optimum, using climatological covariance matrices.



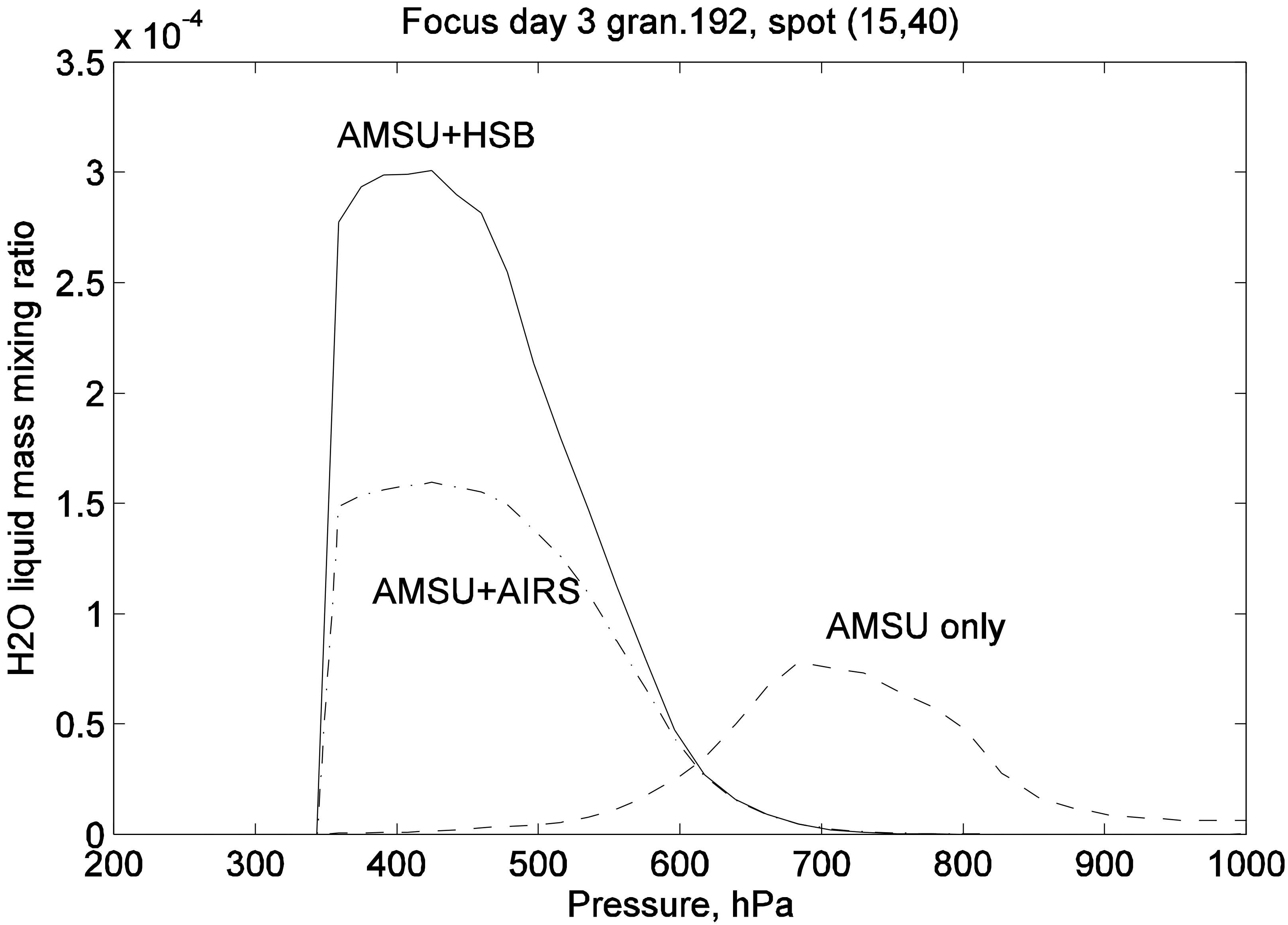
The MIT retrieval estimates cloud liquid water by means of a generalized relative humidity variable; hence the relative humidity from the cloudy regression can introduce information from AIRS through the *a priori* profile:



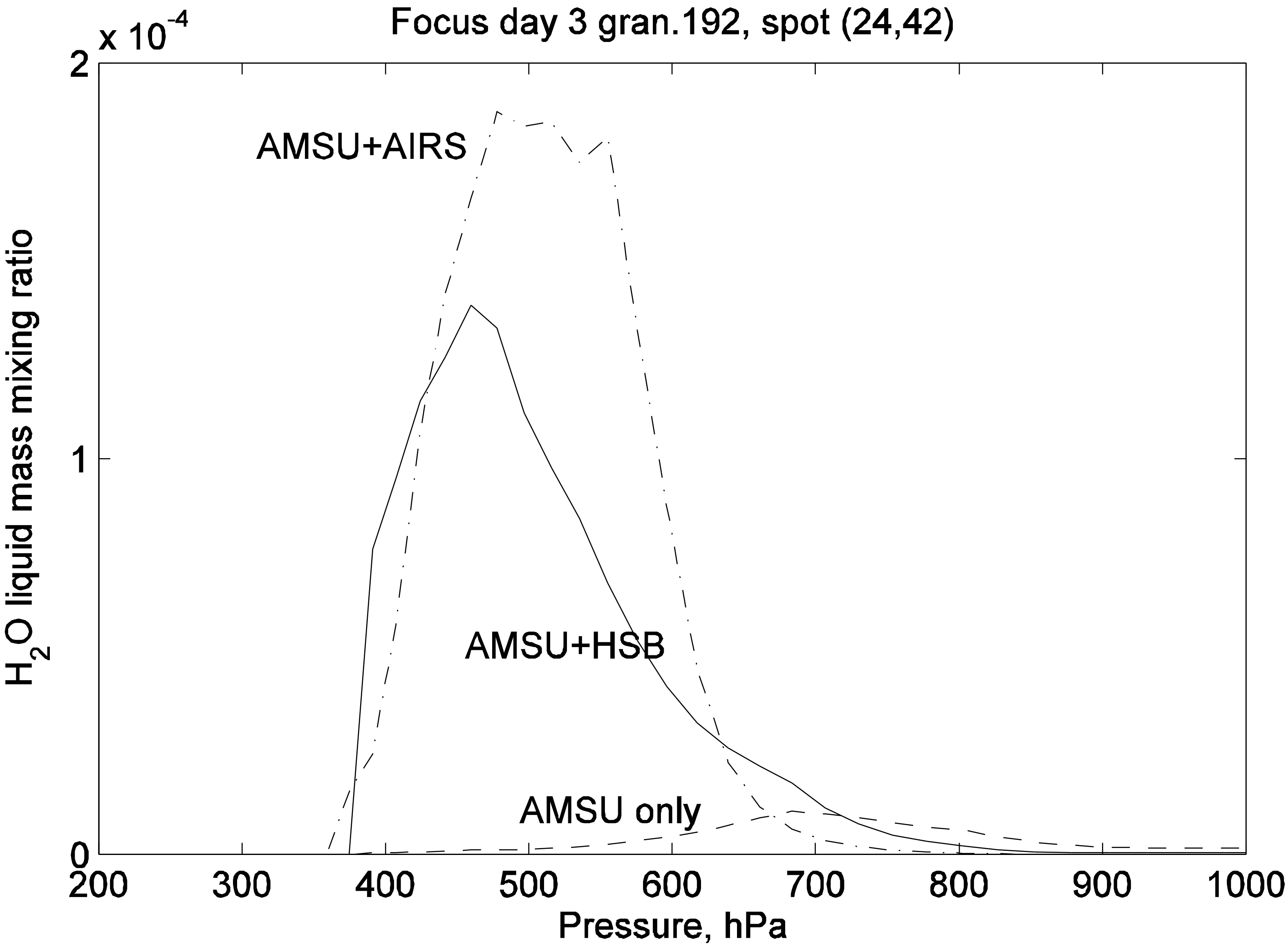
Integrated liquid water is more widely distributed with an AMSU+AIRS retrieval than with AMSU-only, although not as much as with AMSU+HSB.



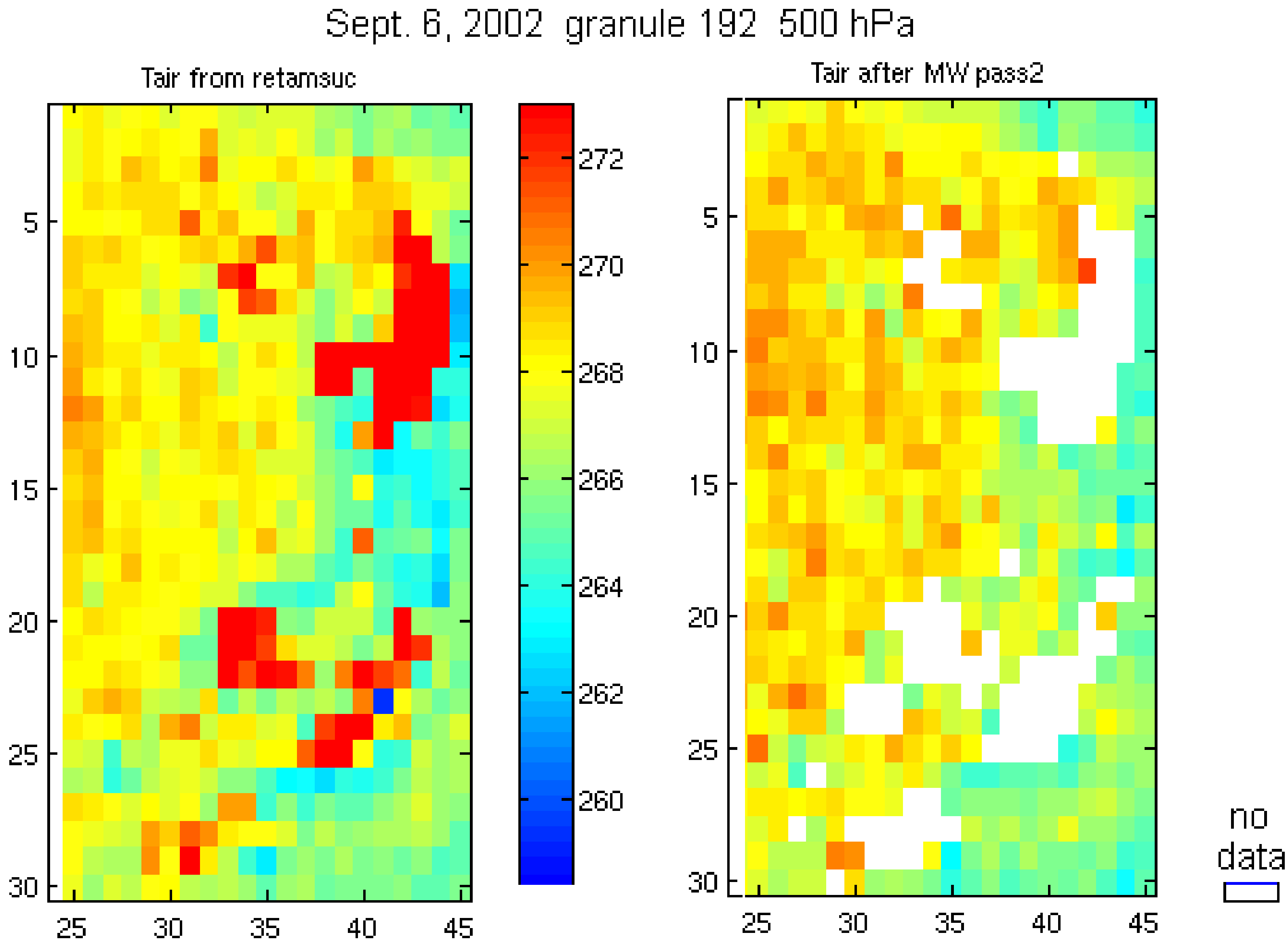
The vertical distribution of liquid water from AMSU+AIRS is closer to AMSU+HSB than is AMSU-only.



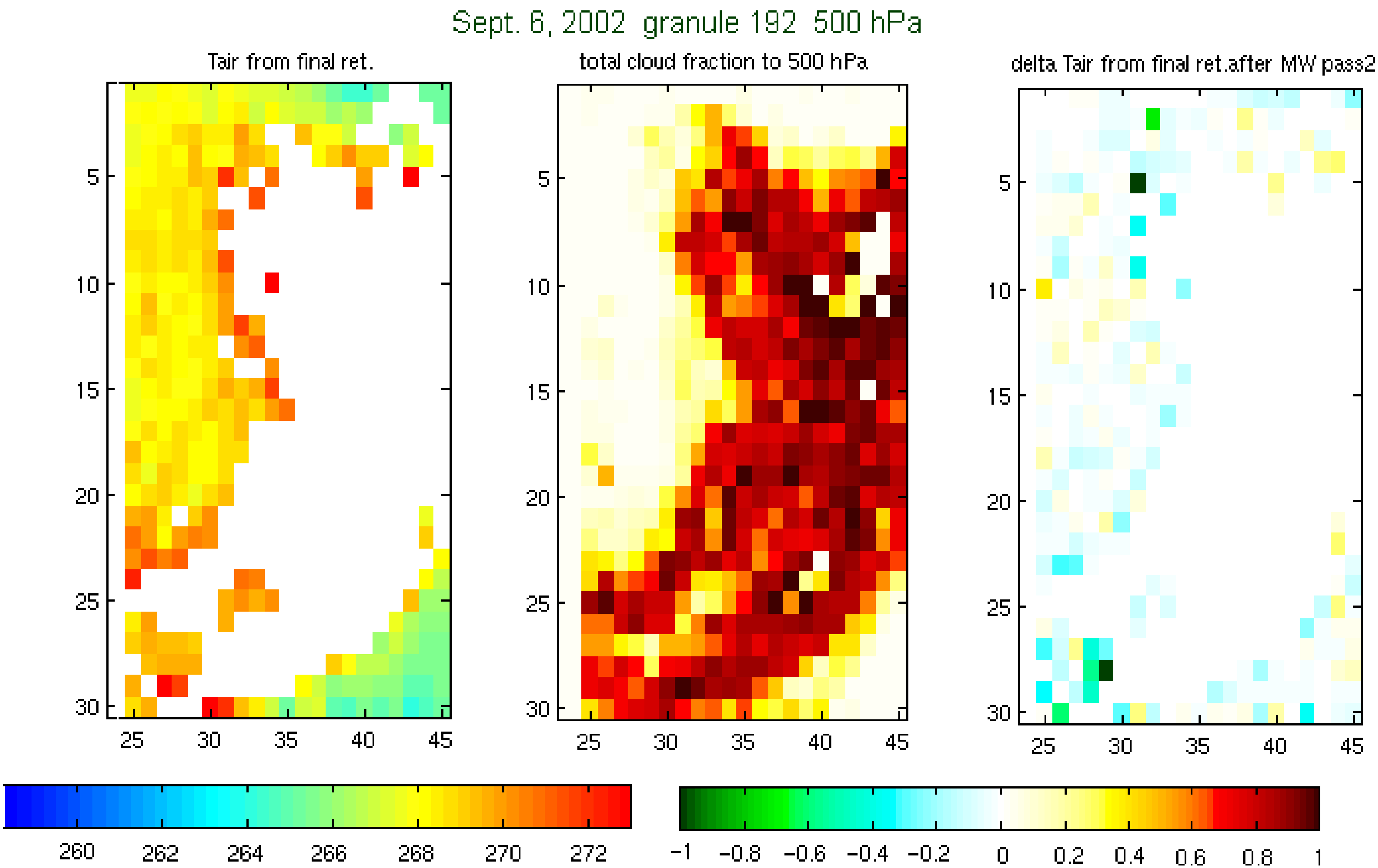
In a few locations, the retrieved liquid is greater with AMSU+AIRS.



500-mb temperature is depressed in cloudy areas after the retamsuc AMSU-retrieval step, but less so with the improved liquid water profile in the MIT retrieval.



The final retrieval rejects (according to pbest) most cloudy profiles in V5. Some over-correction is noticeable at the cloud edges.



Conclusions on tuning:

1. Window-channel tuning needs to be scene-dependent in order to apply it to both ocean and land cases.

2. Tuning derived from land cases yields corrections as expected from sidelobe effects.

3. The bias of AMSU antenna temperatures relative to the AIRS retrieval changes with time as well as with retrieval version.

Conclusions on MIT second pass:

1. Cloud liquid retrieval is improved.

2. Benefit to the final temperature retrieval may result, if QA is revised.